www.dynamicpapers.com

Pearson
Edexcel

# Mark Scheme (Results)

## January 2020

Pearson International Advanced Subsidiary Level
In Chemistry (WCH13)
Paper 01 Practical Skills in Chemistry

www.dynamicpapers.com

**Edexcel and BTEC Qualifications**

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

**Pearson: helping people progress, everywhere**

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

January 2020
Publications Code WCH13_01_2001_MS
All the material in this publication is copyright
© Pearson Education Ltd 2020

www.dynamicpapers.com

**General Marking Guidance**

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

www.dynamicpapers.com

**Using the Mark Scheme**

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:

- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.

( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.

Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.

ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **1(a)(i)** | • (colourless sodium chloride) becomes brown / orange / yellow / darker<br>Or<br>• bromine water turns lighter in colour (due to dilution) **(1)**<br><br>• (Sodium iodide) solution turns darker/brown/orange **(1)** | Standalone marks<br>Do not award additional incorrect observations<br>Ignore reference to layers<br><br>Allow<br>No change / no (visible) reaction<br>or<br>Remains brown/orange / yellow<br><br>Do not award<br>any indication of a reaction<br>any other colour<br><br>Allow black or grey **solid**<br><br>Do not award purple (vapour, solution, solid) | **(2)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **1(a)(ii)** | • Test: Flame Test **(1)**<br><br>• Observation: Yellow **(1)** | <br><br>Allow Orange or yellow-orange<br><br>Ignore persistent / golden/ bright (yellow) | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **1(b)(i)** | • Ammonium sulfate White precipitate /solid **(1)**<br><br>• Ammonium nitrate No change / no reaction **(1)** | Allow ppt for precipitate<br>Do not award if any additional observations are made such as bubbles/fumes<br><br>Allow no precipitate / no observation<br>Ignore any formulae even if incorrect | **(2)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **1(b)(ii)** | • Test: (add) (aqueous) sodium hydroxide (heat) **(1)**<br><br>• Result: **Gas** evolved which turns (damp) red litmus blue **(1)** | Allow any hydroxide<br><br>Accept<br>white smoke with HCl<br><br>Allow<br>**Gas** turns litmus blue / **Gas** turns universal indicator blue<br>pungent smelling **gas**<br><br>Ignore $NH_3$ / alkali gas / steamy fumes<br><br>The result mark is dependent on the correct test or just 'heat' for the test with no sodium hydroxide. | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | | Additional Guidance | Mark |
|---|---|---|---|---|
| **1(c)(i)** | • (Turns) green | **(1)** | Allow blue / blue-green / green-blue / Grey-green<br>Ignore smell<br>Do not award if additional observations are made e.g. bubbles | **(2)** |
| | • No change/no reaction/remains orange | **(1)** | Allow no observation<br><br>Colours reversed scores one mark<br><br>If wrong starting colour stated max 1 | |

| Question Number | Answer | | Additional Guidance | Mark |
|---|---|---|---|---|
| **1(c)(ii)** | | | The result mark depends on a correct test or near miss | **(2)** |
| | • Test: phosphorus(V)chloride/ $PCl_5$ | **(1)** | Allow phosphorus pentachloride / thionyl chloride / $SOCl_2$ / $PCl_3$ | |
| | • Result: Steamy fumes/ white fumes/misty fumes | **(1)** | Do not award white smoke<br><br>Ignore effervescence/gas turns litmus red/gas forms white smoke with $NH_3$ | |
| | OR | | | |
| | • Test: sodium/Na | **(1)** | Accept gas given off burns with a squeaky pop<br>Allow white solid / sodium dissolves | |
| | • Result: effervescence / bubbles/fizzing | **(1)** | | |
| | OR | | | |
| | • Test: add any named carboxylic acid and (conc) sulfuric acid (and warm) | **(1)** | Allow just carboxylic acid and any named strong acid | |
| | • Result: (product has) sweet/fruity/ester smell | **(1)** | | |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **1(d)** | • Hexane: (forms two layers and the lower layer) remains pink/purple **(1)**<br><br>• Hexene: (potassium manganate(VII)) turns colourless **(1)** | Allow<br>no change / no reaction / no observation<br>Ignore shades of pink / purple<br><br>Allow 1 mark if the observations are reversed<br><br>Do not award if the wrong colour is stated | **(2)** |

**(Total for Question 1 = 14 Marks)**

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **2(a)(i)** | • **M1** Mass of 10 cm length of Mg ribbon **(1)**<br><br>• **M2** Converting mass of Mg ribbon to moles **(1)** | Penalise rounding errors once only in 2a and 2bi and nowhere else in the paper.<br><br>Example of calculation<br>0.86/10 = 0.086 (g)<br><br>0.086/24.3 = $3.5391 \times 10^{-3}$ / 0.0035391 (mol)<br><br>$=3.54 \times 10^{-3}$ (mol) / 0.00354 (mol)<br>Do not award rounding error, e.g. $3.53 \times 10^{-3}$<br><br>TE on any incorrect mass in M1<br><br>Ignore SF except 1SF<br><br>Use of 24 gives $3.5833 \times 10^{-3}$ scores (2)<br><br>Correct answer with or without working scores(2) | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | | Additional Guidance | Mark |
|---|---|---|---|---|
| **2(a)(ii)** | | | Example of calculation | **(4)** |
| | • **M1** Calculates temp change | **(1)** | 29.2 − 21.4 = 7.8 (°C) | |
| | • **M2** Calculates energy change | **(1)** | 50 x 4.2 x 7.8 = 1638 (joules) / 1.638 kJ<br>Ignore minus sign | |
| | • **M3** energy/moles | **(1)** | 1638/3.5391 x $10^{-3}$ (= 462830) | |
| | • **M4** Completion of calculation, correct sign and units and 1, 2 or 3SF | **(1)** | −463 / −460/−500 kJ $mol^{-1}$<br>Or −463000 / −460000 /−500000 J $mol^{-1}$<br><br>Correct answer with or without working scores all marks<br><br>Use of 24 gives −457 kJ $mol^{-1}$scores (4)<br><br>Allow TE from (a)(i) and M1 to M3. | |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 2(b)(i) | • Calculation of percentage uncertainty | Example of calculation<br><br>$\frac{(+/-)\ 0.1 \times 2}{7.8} \times 100 = 2.56\ (\%)$<br><br>Allow TE for wrong temperature change<br><br>Do not award if either temp used<br><br>Ignore SF | **(1)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| 2(b)(ii) | An explanation that makes reference to the following points:<br><br>**M1**<br>• Use greater mass of magnesium<br><br>**Or**<br><br>• Smaller volume of hydrochloric acid **(1)**<br><br>**M2**<br><br>(So the) temperature **change** will be greater/temperature will **increase** more **(1)** | Standalone marks. Even if the answer to M1 would not produce a temperature rise M2 can be scored.<br><br>Allow<br>More magnesium<br><br>Allow<br>Less hydrochloric acid<br>Ignore increase the concentration of hydrochloric acid<br><br>Do not award reduce the concentration of the hydrochloric acid<br><br>Do not award temperature cooling curve or any other changes to the procedure to reduce heat loss | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **2(c)** | An explanation that makes reference to the following points:<br><br>**M1**<br>• The enthalpy change will be less negative / less exothermic **(1)**<br><br>**M2**<br>• The heat loss will be greater<br><br>Or<br><br>• (Because) polystyrene is a better insulator<br><br>Or<br><br>• More energy is used to heat the container/ glass<br><br>Or<br><br>• (Because) the polystyrene cup has a low heat capacity **(1)** | Allow reverse arguments for **M2**<br><br>Allow lower/smaller<br><br>Allow glass absorbs heat<br><br>Ignore references to the mechanism of heat loss<br>No TE on incorrect **M1** | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **2(d)** | An explanation that makes reference to the following points:<br><br>• **M1** To remove magnesium oxide **(1)**<br><br>• **M2** The two enthalpy changes would be different **(1)** | Allow<br>The magnesium is oxidised / corroded / tarnished<br>Ignore just impurities<br>Do not award rust<br><br>Allow<br>The enthalpy change will be less exothermic / less negative<br>Allow<br>Only Mg is being weighed / reacted<br>Or<br>So the Mg is pure<br>Or<br>the mass of Mg would be lower if the layer were not removed.<br><br>Ignore any references to rate of reaction | **(2)** |

**(Total for Question 2 = 13 marks)**

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **3(a)** | • (From) Yellow **(1)**<br>• (to) orange **(1)** | Do not award red<br>Colours correct in reverse order scores (1) | **(2)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **3(b) (i)** | <table><tr><td>Number of titration</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Burette reading (final) / $cm^3$</td><td>27.55</td><td>26.25</td><td>28.30</td><td>26.15</td></tr><tr><td>Burette reading (start) / $cm^3$</td><td>0.00</td><td>0.05</td><td>1.05</td><td>0.05</td></tr><tr><td>Volume of HCl used / $cm^3$</td><td>**27.55**</td><td>**26.2(0)**</td><td>**27.25**</td><td>**26.1(0)**</td></tr></table><br>4 correct values (1)<br>correct calculation using concordant values (1) | Example of calculation<br>(26.10 + 26.20= 52.30/2) = 26.15 ($cm^3$)<br>TE on incorrect subtractions as long as the values chosen are concordant. | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **3(b)(ii)** | Possible route through the calculation<br><br>• **M1** Calculation of the amount of hydrochloric acid (1)<br><br>• **M2** Calculation of the amount of sodium carbonate in 25 $cm^3$ (1:2 ratio) (1)<br><br>• **M3** $M_r$ $Na_2CO_3$ (1)<br><br>• **M4** Mass of $Na_2CO_3$ in 250 $cm^3$ (1)<br><br>• **M5** Calculation of the percentage purity of $Na_2CO_3$ (1) | Example of calculation<br>TE on mean titre from (b)(i)<br><br>Mol of HCl = 26.15 x 0.200/1000<br>= 5.23 x $10^{-3}$/ 0.00523 (mol)<br><br>Mol of $Na_2CO_3$ = 5.23 x $10^{-3}$/2<br>= 2.615 x $10^{-3}$ / 0.002615 (mol)<br><br>106 or allow correct value used in a calculation<br><br>= 2.615 x $10^{-3}$ x 10 x 106 = 2.7719 (g)<br><br>2.7719/4.89 x100 = 56.685 = 56.7 (%)<br><br>TE at each stage<br><br>IGNORE SF except 1<br><br>% impurity 43.315 % scores (4)<br><br>Correct answer with or without working scores (5) marks<br><br>Ignore rounding errors | **(5)** |

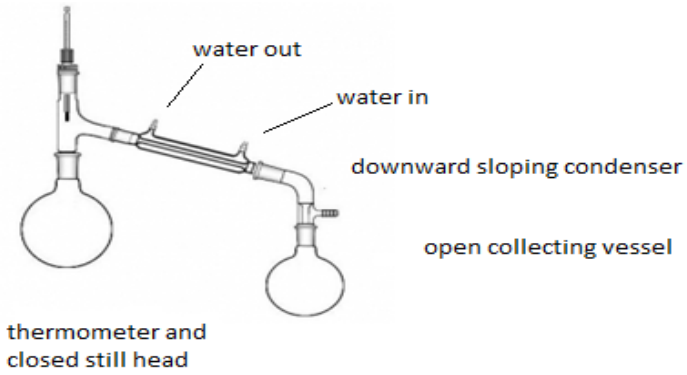
**(Total for Question 3 = 9 marks)**

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(a)** | An explanation that makes reference to the following points:<br><br>• the reaction is exothermic **(1)**<br><br>• prevents the mixture boiling over **(1)** | <br><br>Allow the reaction gives out heat<br>Ignore the reaction is vigorous<br><br>Allow<br>To prevent the ethanol evaporating/boiling<br>To prevent bubbling / spitting / spraying / splattering<br><br>Ignore splashing / explosions / spilling / cracking flasks | **(2)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(b)** | An answer that makes reference to the following points:<br><br>• increases / speeds up the rate of reaction **(1)**<br><br>• because the surface area (of the potassium bromide) is increased **(1)** | Standalone marks<br><br><br><br>Allow large surface area<br><br>Ignore goes to completion | **(2)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(c)(i)** | A diagram that shows the following points:<br><br>• **M1** Round-bottomed flask, heat and thermometer in the correct position opposite the condenser opening. **(1)**<br><br>• **M2** Correct downward sloping condenser **and** water flowing in the correct direction **(1)**<br><br>• **M3** No gaps on the LHS and open collecting vessel or vent **(1)** | Allow<br>Pear-shaped flask, arrow for heat / **hot** water bath / electric heater / Bunsen burner<br>The bulb of the thermometer anywhere above the flask<br>One-piece apparatus<br><br>Do not award conical flask<br><br>Ignore lack or presence of anti-bumping granules<br><br>Ignore fractional distillation column<br><br>Ignore lines between apparatus<br><br><br><br><br>Reflux apparatus can only score one mark for correct flask, heat and condenser with the correct correct water flow | **(3)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(c)(ii)** | • Promotes smooth or even boiling<br>or<br>Provides sites for bubbles to form / site for nucleation / promotes (small) bubble formation | Allow to stir the mixture<br><br>Allow to prevent the formation of large bubbles / to break up large bubbles<br><br>Ignore to prevent bumping | **(1)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(d)(i)** | Any 2 of the following<br>• The density of bromobutane is great**er** (than the aqueous layer) **(1)**<br><br>• Bromoethane is immiscible (with water) **(1)**<br><br>• Bromoethane is a liquid (at room temperature) **(1)** | Allow water/ 1 g $cm^{-3}$<br>reverse argument<br><br>Allow does not mix / insoluble (in water) / bromoethane is non polar | **(2)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(d)(ii)** | A description that makes reference to the following points:<br><br>• (open the tap and) run off the bromobutane layer into a beaker (and discard the aqueous layer)<br>or<br>Remove the aqueous layer with a (teat) pipette/ syringe | Do not award<br>Just pouring off/decant the aqueous layer from the top | **(1)** |

www.dynamicpapers.com

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(e)** | • To neutralise the acid / $H^+$ ions / $H_3O^+$ | Allow<br>Remove the acid<br>Hydrobromic acid / sulfuric acid<br><br>Ignore reference to impurities | **(1)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(f)(i)** | • (solid) (anhydrous) calcium chloride/sodium sulfate/calcium sulfate/magnesium sulfate | Name or correct formula.<br><br>Allow<br>silica gel<br><br>Do not award<br>Conc $H_2SO_4$ / anhydrous copper sulfate<br><br>If a list is given all must be suitable drying agents to score.<br>If name and formula given both must be correct. | **(1)** |

| Question Number | Answer | Additional Guidance | Mark |
|---|---|---|---|
| **4(f)(ii)** | • (Bromoethane) becomes less cloudy/ goes clear | Do not award just colourless<br><br>Ignore any stated colour as long as it does not change. | **(1)** |

**(Total for Question 4 = 14 Marks)**
**Total for the paper = 50 Marks**

www.dynamicpapers.com

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom